(6)

* NOTICES *

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OPERATION

[Function]
While rotating the stirring aerofoil 20 for downward flow acceleration, and the stirring aerofoil 22 for pars-basilaris-ossis-occipitalis liquid discharge acceleration and accelerating the downward flow of culture medium at the same time it rotates the draft tube 10 installed by concentric circular in the cultivation tank 12 with the driving gear (not shown) of the tub exterior, it discharges accelerating the liquid in the draft tube out of the draft tube. The oxygen supply to culture medium blows off air from the powder trachea 24 installed in the draft tube outsole section in the shape of a periphery upward, and it is performed, accelerating the upward flow of the culture medium of the periphery section.
Moreover, when the powder trachea 46 is installed in the draft tube, air is blown off downward from the powder trachea 46, and air is mixed, accelerating the downward flow of the culture medium in the draft tube.
Furthermore, when projections 28 and 44 are formed in the draft tube periphery section, the upward flow of the culture medium of the periphery section is accelerated with the rotating draft tube.
[0007]

[Translation done.]

EXAMPLE

[Example]
Hereafter, the suitable example of this design is explained to a detail with reference to a drawing. However, the configuration of the configuration equipment indicated by this example, its relative configuration, etc. are only not a thing but the mere examples of explanation of those meanings limited to seeing about the range of this design, as long as there is no specific publication especially.
Example 1 In drawing 1 , 10 is the cylinder-like draft tube with which the vertical edge was opened wide, and it is installed in concentric circular so that a gap may be generated in the cylinder-like vertical mold cultivation tank 12 between the tub side attachment wall 14, the bottom of the tank wall 16, and a cistern cap 18.
The stirring aerofoil 20 for downward flow acceleration is formed in the upper part in the draft tube 10, and the stirring aerofoil 22 for pars-basilaris-ossis-occipitalis liquid discharge acceleration is formed in the draft tube 10 bottom. The powder trachea 24 is formed in the outsole section of the draft tube 10. 26 is a revolving shaft and is for rotating the draft tube 10, the stirring aerofoil 20 for downward flow acceleration, and the stirring aerofoil 22 for pars-basilaris-ossis-occipitalis liquid discharge acceleration. When the draft tube rotates, the shape of a spiral of a configuration which the upward force produces, and the inclination tabular projection 28 are formed in the periphery section of the draft tube 10. Moreover, two or more slits 30 are formed in the upper part of the draft tube 10. This slit 30 is for making liquid flow in the draft tube 10, when an oil level descends up to the slit 30 neighborhood. For a connection implement for 32 and 34 to connect the draft tube 10 and a revolving shaft 26 and 36, as for a culture medium inlet port and 40, a baffle and 38 are [a liquid outlet and 42] exhaust ports.
[0008]
Example 2 Instead, this example forms the projection 44 of discontinuity for the continuous projection, as shown in drawing 2 . Other configurations are the same as that of the case of drawing 1 .
[0009]
Example 3 This example forms the powder trachea 46 which spouts air downward in the draft tube 10, as shown in drawing 3 . As an example, a revolving shaft 26 is made into the shape of hollow, and he supplies air to this centrum, and is trying to spout downward from the powder trachea 46 in drawing 3 . This powder trachea 46 may be formed instead of the powder trachea of a pars basilaris ossis occipitalis, or may prepare both. Other configurations are the same as that of the case of drawing 1 .
[0010]

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the longitudinal-section explanatory view of the culture apparatus in which one example of this design is shown.
[Drawing 2] It is the longitudinal-section explanatory view of the culture apparatus in which other examples of this design are shown.
[Drawing 3] It is the longitudinal-section explanatory view of the culture apparatus in which the example of further others of this design is shown.
[Description of Notations]
10 Draft Tube
12 Cultivation Tank
14 Tub Side Attachment Wall
16 Bottom of the Tank Wall
18 Cistern Cap
20 Stirring Aerofoil for Downward Flow Acceleration
22 Stirring Aerofoil for Pars-Basilaris-Ossis-Occipitalis Liquid Discharge Acceleration
24 Powder Trachea
26 Revolving Shaft
28 Projection
30 Slit
36 Baffle
44 Projection
46 Powder Trachea

[Translation done.]

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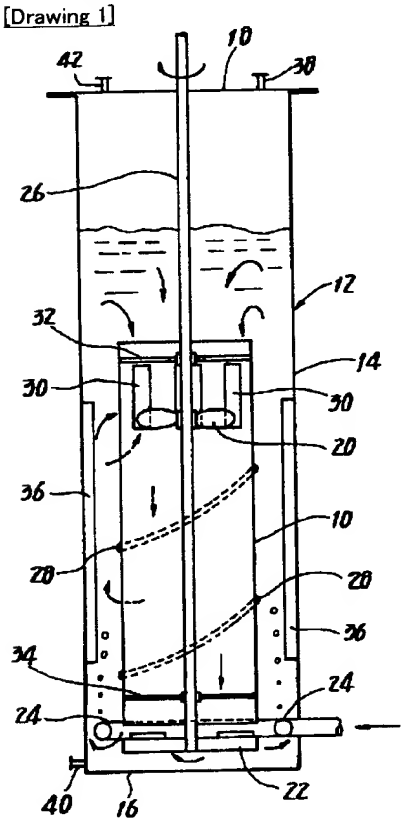
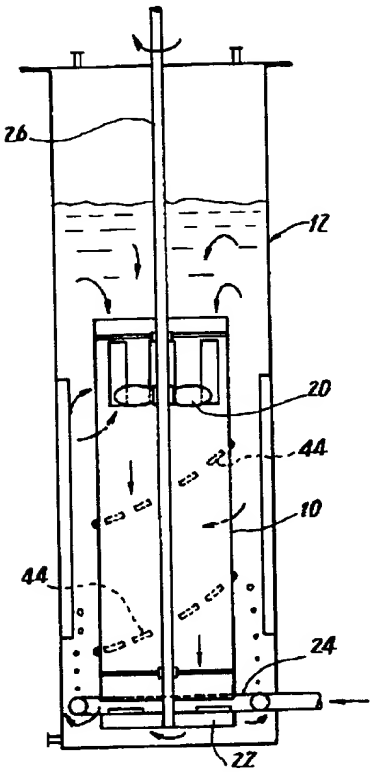
DRAWINGS

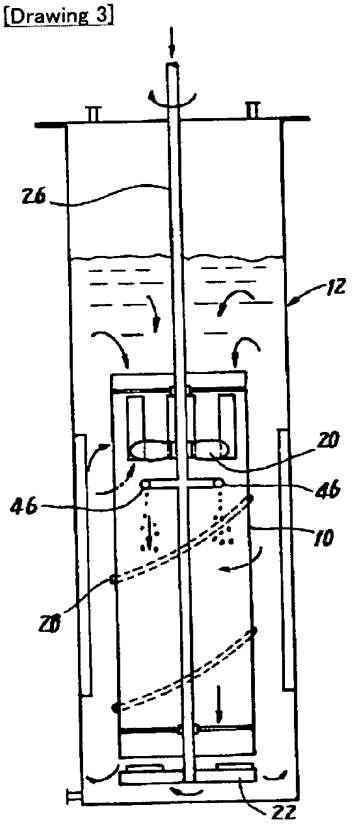
[Drawing 1]



[Drawing 2]



[Drawing 3]



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CLAIMS

[Utility model registration claim]
[Claim 1] In the culture apparatus which installed the draft tube (10) with which the vertical edge was opened wide so that a gap might be generated in a vertical mold cultivation tank (12) between a tub side attachment wall (14), a bottom of the tank wall (16), and a cistern cap (18) The stirring aerofoil for downward flow acceleration prepared in the upper part in the draft tube (10) (20), The stirring aerofoil for pars-basilaris-ossis-occipitalis liquid discharge acceleration prepared near the lower part of the draft tube (10) (22), The culture apparatus characterized by having the powder trachea (24) prepared in the outsole section or the interior of the draft tube (10), (46), and the revolving shaft (26) made to rotate the draft tube (10).
[Claim 2] The culture apparatus according to claim 1 characterized by sharing the revolving shaft of the stirring aerofoil for downward flow acceleration (20), the revolving shaft of the stirring aerofoil for pars-basilaris-ossis-occipitalis liquid discharge acceleration (22), and the revolving shaft (26) for draft tube (10) rotation.
[Claim 3] The culture apparatus according to claim 1 or 2 characterized by preparing the projection (28) of a configuration which the upward force produces when the draft tube rotates, and (44) in the periphery section of the draft tube (10).

[Translation done.]

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DETAILED DESCRIPTION

[Detailed explanation of a design]
[0001]
[Industrial Application]
This design is related with the equipment which cultivates a fungus body, a cell, etc. efficiently in culture medium, and the culture apparatus which mixes hyperviscous culture medium with high vapor-liquid contacting efficiency especially.
[0002]
[Description of the Prior Art]
The mainstream of the conventional culture apparatus was the so-called aeration stirring method which advances a reaction by blowing gas, such as air, from a tub lower part, circulating culture medium, and performing a gas liquid contact while it filled the culture medium which added the fungus body, the cell, etc. in the tub and stirred it with the agitator. However, depending on the class of culture, it may have big effect to a fungus body or a cell by the strong shearing force by stirring. Furthermore, it is necessary to make installation area small, and application in the various culture systems of a vertical mold (column type) cultivation tank is beginning to be considered.
a column — the mainstream of a type cultivation tank was a bubbling tower method which prepares the draft tube in a tub, fills the culture medium which added the fungus body, the cell, etc. in the tub, blows gas, such as air, from a tub lower part, is made to circulate through culture medium, and performs a gas liquid contact.
[0003]
Culture medium is sucked up and the equipment which oxygen is given [equipment] to culture medium and makes it cultivate by having made it flow down from the upper part to the periphery section is indicated by by installing the cylinder (draft tube) which prepared the axial flow impeller in the interior of a cultivation tank in JP,63-251077,A, and rotating an impeller conventionally. Moreover, uniting a cylinder with the periphery of an axial flow impeller, and rotating a cylinder with an impeller is also indicated. Moreover, a slit is attached to a draft tube upper half, the sparger for making the interior diffuse a gas in a liquid is prepared in JP,55-15718,A, and the culture apparatus further equipped with the axial flow impeller which makes the draft tube lowest edge discharge a liquid out of a tube is indicated.
[0004]
[Problem(s) to be Solved by the Device]
However, in the above-mentioned conventional technique, it was not fully able to respond to the liquid fermentation like the liquid culture of an aspergillus which is aerobic culture and serves as hyperviscous conditions.
Moreover, in order that oxygen supply may be dependent only on the gas (air) contamination by culture medium fall in a culture apparatus given in JP,63-251077,A, a limitation is in an oxygen supply rate and the correspondence in the aspergillus culture which needs oxygen supply high also under hyperviscous conditions is difficult.
When viscosity rises, it becomes difficult, the serviceability of oxygen also declines and making a flow of the whole tub into homogeneity stops moreover, being suitable for culture of an aspergillus etc. similarly in the usual culture, in a culture apparatus given in JP,55-15718,A, although high oxygen supply capacity can be demonstrated.
If it becomes hyperviscosity for it to be the stirred tank format generally used often as a cultivation tank, in order to stir only a stirring aerofoil part and to stir the whole tub to homogeneity, mighty stirring power is needed with installation of the shape of a special stirring profile.
In order to make the whole tub into homogeneity in the above-mentioned stirred tank format, when stirring powerfully, with mold, such as an aspergillus, a fungus body tends to receive a damage by mechanical shearing.
It was made in view of above-mentioned many points, even if it is hyperviscous culture medium, it can mix to homogeneity, and this design aims to let vapor-liquid contacting efficiency offer a culture apparatus with few damages to a fungus body highly.
[0005]
[Means for Solving the Problem]
In order to attain the above-mentioned purpose, the culture apparatus of this design In the culture apparatus which installed the draft tube 10 with which the vertical edge was opened wide so that a gap might be generated in the vertical mold cultivation tank 12 between the tub side attachment wall 14, the bottom of the tank wall 16, and a cistern cap 18 when explaining with reference to the drawing The stirring aerofoil 20 for downward flow acceleration prepared in the upper part in the draft tube 10, Stirring aerofoil 22 for pars-basilaris-ossis-occipitalis liquid discharge acceleration prepared near the lower part of the draft tube 10 Powder tracheae 24 and 46 prepared in the outsole section or the interior of the draft tube 10 It is characterized by having the revolving shaft 26 made to rotate the draft tube 10.
In the above-mentioned culture apparatus, it is desirable to constitute so that the revolving shaft of the stirring aerofoil 20 for downward flow acceleration, the revolving shaft of the stirring aerofoil 22 for pars-basilaris-ossis-occipitalis liquid discharge acceleration, and the revolving shaft 26 of ten draft tube diversion may be shared.
Moreover, it is desirable to form the projections 28 and 44 of a configuration which the upward force produces when the draft tube rotates in the periphery section of the draft tube 10.
[0006]
[Function]
While rotating the stirring aerofoil 20 for downward flow acceleration, and the stirring aerofoil 22 for pars-basilaris-ossis-occipitalis liquid discharge acceleration and accelerating the downward flow of culture medium at the same time it rotates the

draft tube 10 installed by concentric circular in the cultivation tank 12 with the driving gear (not shown) of the tub exterior, it discharges accelerating the liquid in the draft tube out of the draft tube. The oxygen supply to culture medium blows off air from the powder trachea 24 installed in the draft tube outsole section in the shape of a periphery upward, and it is performed, accelerating the upward flow of the culture medium of the periphery section.
Moreover, when the powder trachea 46 is installed in the draft tube, air is blown off downward from the powder trachea 46, and air is mixed, accelerating the downward flow of the culture medium in the draft tube.
Furthermore, when projections 28 and 44 are formed in the draft tube periphery section, the upward flow of the culture medium of the periphery section is accelerated with the rotating draft tube.
[0007]
[Example]
Hereafter, the suitable example of this design is explained to a detail with reference to a drawing. However, the configuration of the configuration equipment indicated by this example, its relative configuration, etc. are only not a thing but the mere examples of explanation of those meanings limited to seeing about the range of this design, as long as there is no specific publication especially.
Example 1 In drawing 1 , 10 is the cylinder-like draft tube with which the vertical edge was opened wide, and it is installed in concentric circular so that a gap may be generated in the cylinder-like vertical mold cultivation tank 12 between the tub side attachment wall 14, the bottom of the tank wall 16, and a cistern cap 18.
The stirring aerofoil 20 for downward flow acceleration is formed in the upper part in the draft tube 10, and the stirring aerofoil 22 for pars-basilaris-ossis-occipitalis liquid discharge acceleration is formed in the draft tube 10 bottom. The powder trachea 24 is formed in the outsole section of the draft tube 10. 26 is a revolving shaft and is for rotating the draft tube 10, the stirring aerofoil 20 for downward flow acceleration, and the stirring aerofoil 22 for pars-basilaris-ossis-occipitalis liquid discharge acceleration.
When the draft tube rotates, the shape of a spiral of a configuration which the upward force produces, and the inclination tabular projection 28 are formed in the periphery section of the draft tube 10. Moreover, two or more slits 30 are formed in the upper part of the draft tube 10. This slit 30 is for making liquid flow in the draft tube 10, when an oil level descends up to the slit 30 neighborhood. For a connection implement for 32 and 34 to connect the draft tube 10 and a revolving shaft 26 and 36, as for a culture medium inlet port and 40, a baffle and 38 are [a liquid outlet and 42] exhaust ports.
[0008]
Example 2 Instead, this example forms the projection 44 of discontinuity for the continuous projection, as shown in drawing 2 . Other configurations are the same as that of the case of drawing 1 .
[0009]
Example 3 This example forms the powder trachea 46 which spouts air downward in the draft tube 10, as shown in drawing 3 . As an example, a revolving shaft 26 is made into the shape of hollow, and he supplies air to this centrum, and is trying to spout downward from the powder trachea 46 in drawing 3 . This powder trachea 46 may be formed instead of the powder trachea of a pars basilaris ossis occipitalis, or may prepare both. Other configurations are the same as that of the case of drawing 1 .
[0010]
[Effect of the Device]
Since this design is constituted as mentioned above, it does the following effectiveness so.
(1) Also to the hyperviscosity at the time of high concentration fungus body culture etc. (non-Newtonian fluid), the whole inside of a tub can be mixed to homogeneity, and vapor-liquid contacting efficiency becomes high.
(2) Since the stirring aerofoil for pars-basilaris-ossis-occipitalis liquid discharge acceleration is prepared near the lower part of the draft tube while preparing the stirring aerofoil for downward flow acceleration in the upper part in the draft tube, culture medium can be circulated efficiently.
(3) When preparing the projection of spiral-like continuation or discontinuity in the periphery section of the draft tube, culture medium flows in the shape of a spiral in the periphery section of the draft tube, for this reason, a part of fungus body carries out self-****, and high concentration-ization of a fungus body is promoted. Moreover, in order to make a liquid mainly flow with the rotational energy of the draft tube, there are few damages to a fungus body.

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TECHNICAL FIELD

[Industrial Application]
This design is related with the equipment which cultivates a fungus body, a cell, etc. efficiently in culture medium, and the culture apparatus which mixes hyperviscous culture medium with high vapor-liquid contacting efficiency especially.
[0002]

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PRIOR ART

[Description of the Prior Art]
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a column — the mainstream of a type cultivation tank was a bubbling tower method which prepares the draft tube in a tub, fills the culture medium which added the fungus body, the cell, etc. in the tub, blows gas, such as air, from a tub lower part, is made to circulate through culture medium, and performs a gas liquid contact.
[0003]
Culture medium is sucked up and the equipment which oxygen is given [equipment] to culture medium and makes it cultivate by having made it flow down from the upper part to the periphery section is indicated by by installing the cylinder (draft tube) which prepared the axial flow impeller in the interior of a cultivation tank in JP,63-251077,A, and rotating an impeller conventionally. Moreover, uniting a cylinder with the periphery of an axial flow impeller, and rotating a cylinder with an impeller is also indicated. Moreover, a slit is attached to a draft tube upper half, the sparger for making the interior diffuse a gas in a liquid is prepared in JP,55-15718,A, and the culture apparatus further equipped with the axial flow impeller which makes the draft tube lowest edge discharge a liquid out of a tube is indicated.
[0004]

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EFFECT OF THE INVENTION

[Effect of the Device]
Since this design is constituted as mentioned above, it does the following effectiveness so.
(1) Also to the hyperviscosity at the time of high concentration fungus body culture etc. (non-Newtonian fluid), the whole inside of a tub can be mixed to homogeneity, and vapor-liquid contacting efficiency becomes high.
(2) Since the stirring aerofoil for pars-basilaris-ossis-occipitalis liquid discharge acceleration is prepared near the lower part of the draft tube while preparing the stirring aerofoil for downward flow acceleration in the upper part in the draft tube, culture medium can be circulated efficiently.
(3) When preparing the projection of spiral-like continuation or discontinuity in the periphery section of the draft tube, culture medium flows in the shape of a spiral in the periphery section of the draft tube, for this reason, a part of fungus body carries out self-****, and high concentration-ization of a fungus body is promoted. Moreover, in order to make a liquid mainly flow with the rotational energy of the draft tube, there are few damages to a fungus body.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Device]
However, in the above-mentioned conventional technique, it was not fully able to respond to the liquid fermentation like the liquid culture of an aspergillus which is aerobic culture and serves as hyperviscous conditions.
Moreover, in order that oxygen supply may be dependent only on the gas (air) contamination by culture medium fall in a culture apparatus given in JP,63-251077,A, a limitation is in an oxygen supply rate and the correspondence in the aspergillus culture which needs oxygen supply high also under hyperviscous conditions is difficult.
When viscosity rises, it becomes difficult, the serviceability of oxygen also declines and making a flow of the whole tub into homogeneity stops moreover, being suitable for culture of an aspergillus etc. similarly in the usual culture, in a culture apparatus given in JP,55-15718,A, although high oxygen supply capacity can be demonstrated.
If it becomes hyperviscosity for it to be the stirred tank format generally used often as a cultivation tank, in order to stir only a stirring aerofoil part and to stir the whole tub to homogeneity, mighty stirring power is needed with installation of the shape of a special stirring profile.
In order to make the whole tub into homogeneity in the above-mentioned stirred tank format, when stirring powerfully, with mold, such as an aspergillus, a fungus body tends to receive a damage by mechanical shearing.
It was made in view of above-mentioned many points, even if it is hyperviscous culture medium, it can mix to homogeneity, and this design aims to let vapor-liquid contacting efficiency offer a culture apparatus with few damages to a fungus body highly.
[0005]

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MEANS

[Means for Solving the Problem]
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Moreover, it is desirable to form the projections 28 and 44 of a configuration which the upward force produces when the draft tube rotates in the periphery section of the draft tube 10.
[0006]

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12) **公開実用新案公報**（Ｕ）　(11)実用新案出願公開番号

実開平5－29400

(43)公開日　平成５年(1993)４月20日

(51)Int.Cl.[5]		識別記号	庁内整理番号	ＦＩ	技術表示箇所
Ｃ１２Ｍ	1/08		2104－4B		
	1/02		A 2104－4B		

審査請求　未請求　請求項の数３(全　２　頁)

(21)出願番号　実願平3－85787

(22)出願日　平成３年(1991)９月24日

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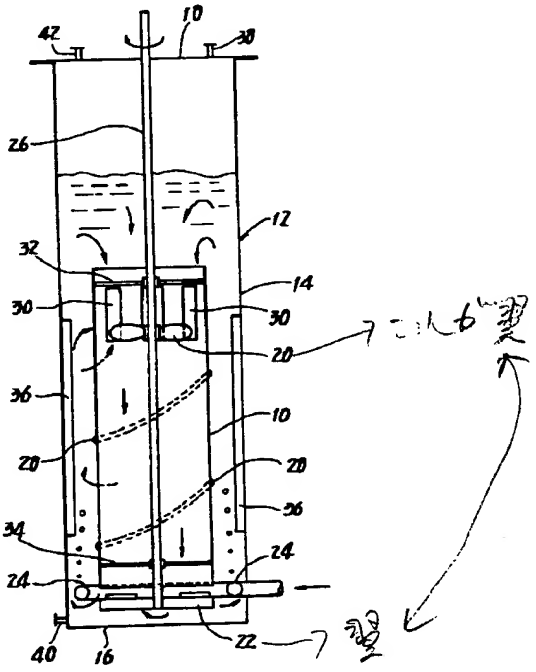
(54)【考案の名称】　培養装置

(57)【要約】　（修正有）

【目的】　菌体、細胞等を培養液中で効率よく培養する。とくに、高粘度の培養液を高い気液接触効率で混合することを目的とする。

【構成】　回転するドラフトチューブ１０の上部に下降流加速用撹拌翼２０を設け、ドラフトチューブ１０の下部近傍に底部液排出加速用撹拌翼２２を設け、ドラフトチューブ１０の外底部又は内部に散気管２４、４６を設ける。さらには、ドラフトチューブ１０の外周部に、回転することにより上向きの力が生じる突起物２８、４４を設ける。



1

【実用新案登録請求の範囲】

【請求項１】　上下端が開放されたドラフトチューブ（１０）を、縦型培養槽（１２）内に槽側壁（１４）、槽底壁（１６）及び槽蓋（１８）との間に間隙が生じるように設置した培養装置において、

ドラフトチューブ（１０）内の上部に設けられた下降流加速用撹拌翼（２０）と、

ドラフトチューブ（１０）の下部近傍に設けられた底部液排出加速用撹拌翼（２２）と、

ドラフトチューブ（１０）の外底部又は内部に設けられた散気管（２４）、（４６）と、

ドラフトチューブ（１０）を回転させる回転軸（２６）と、

を備えたことを特徴とする培養装置。

【請求項２】　下降流加速用撹拌翼（２０）の回転軸と、底部液排出加速用撹拌翼（２２）の回転軸と、ドラフトチューブ（１０）回転用の回転軸（２６）とを共用するようにしたことを特徴とする請求項１記載の培養装置。

【請求項３】　ドラフトチューブ（１０）の外周部に、ドラフトチューブが回転することにより上向きの力が生じるような形状の突起物（２８）、（４４）を設けたことを特徴とする請求項１又は２記載の培養装置。

＊

2

＊【図面の簡単な説明】

【図１】本考案の一実施例を示す培養装置の縦断面説明図である。

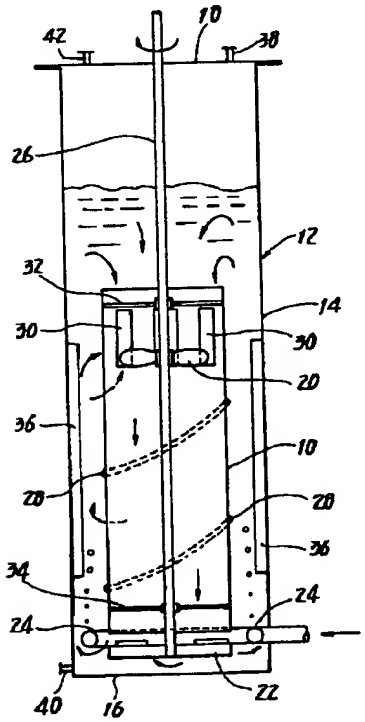
【図２】本考案の他の実施例を示す培養装置の縦断面説明図である。

【図３】本考案のさらに他の実施例を示す培養装置の縦断面説明図である。

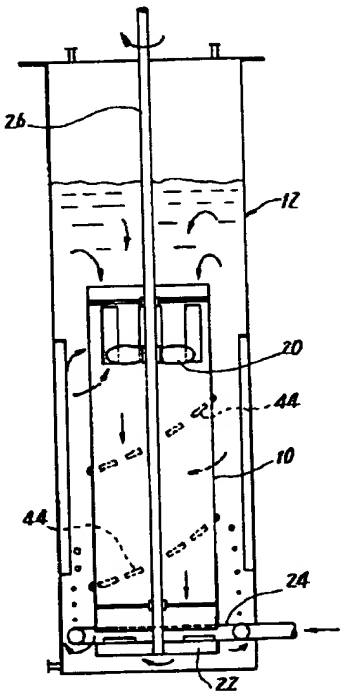
【符号の説明】

１０　ドラフトチューブ
１２　培養槽
１４　槽側壁
１６　槽底壁
１８　槽蓋
２０　下降流加速用撹拌翼
２２　底部液排出加速用撹拌翼
２４　散気管
２６　回転軸
２８　突起物
３０　スリット
３６　邪魔板
４４　突起物
４６　散気管

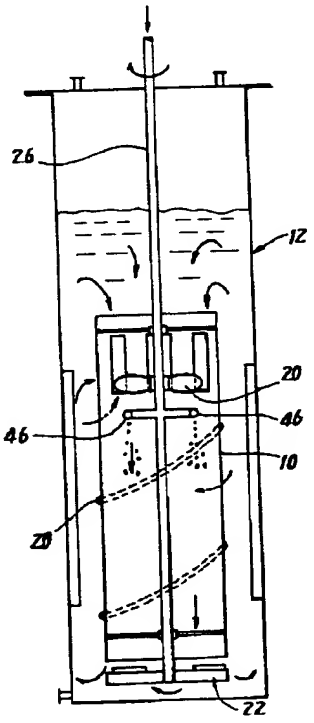
【図１】



【図２】



【図３】



【考案の詳細な説明】

【０００１】

【産業上の利用分野】

本考案は、菌体、細胞等を培養液中で効率よく培養する装置、とくに、高粘度の培養液を高い気液接触効率で混合する培養装置に関するものである。

【０００２】

【従来の技術】

従来の培養装置の主流は、槽内に菌体、細胞等を加えた培養液を満たし、撹拌機により撹拌するとともに、槽下方から空気等のガスを吹き込んで、培養液を循環させて気液接触を行なうことにより反応を進行させる、いわゆる通気撹拌方式であった。しかし、培養の種類によっては、撹拌による強いせん断力で菌体又は細胞へ大きな影響を与える場合がある。さらに、設置面積を小さくする必要もあり、縦型（塔型）培養槽の各種培養系への適用が検討されだしている。

塔型培養槽の主流は、ドラフトチューブを槽内に設け、槽内に菌体、細胞等を加えた培養液を満たし、槽下方から空気等のガスを吹き込んで、培養液を循環させて気液接触を行なう気泡塔方式であった。

【０００３】

従来、特開昭６３－２５１０７７号公報には、培養槽内部に、軸流羽根車を設けた円筒（ドラフトチューブ）を設置し、羽根車を回転させることにより、培養液を吸い上げ、上部から外周部へ流下させたことで酸素を培養液に与え培養させる装置が記載されている。また、円筒を軸流羽根車の外周と一体化して、羽根車とともに円筒を回転させることも記載されている。

また、特開昭５５－１５７１８号公報には、ドラフトチューブ上半分にスリットを付け、その内部に、気体を液体中に拡散させるためのスパージャーを設け、さらに、ドラフトチューブ最下端に、液体をチューブ外へ排出させる軸流インペラーを備えた培養装置が記載されている。

【０００４】

【考案が解決しようとする課題】

しかし、上記の従来技術においては、麹菌の液体培養のごとき、好気性培養で

、かつ高粘度条件となる液体発酵には、十分に対応できなかった。

また、特開昭６３－２５１０７７号公報記載の培養装置では、酸素供給が培養液落下による気体（空気）巻き込みにのみ依存するため、酸素供給速度に限界があり、高粘度条件下でも高い酸素供給が必要な麹菌培養等での対応は難しい。

また、特開昭５５－１５７１８号公報記載の培養装置では、通常の培養においては、高い酸素供給能力を発揮できるが、粘度が上昇した場合、槽全体の流動を均一にすることは困難となり、酸素の供給能力も低下し、同じく麹菌等の培養には適さなくなる。

一般に培養槽としてよく使用されている撹拌槽形式であると、高粘度になると、撹拌翼部分のみが撹拌され、槽全体を均一に撹拌するためには、特殊な撹拌翼形状の設置と、強大な撹拌動力が必要となる。

上記の撹拌槽形式で槽全体を均一にするため、強力に撹拌を実施する場合、麹菌等の糸状菌では、機械的なせん断により菌体がダメージを受けやすい。

本考案は、上記の諸点に鑑みなされたもので、高粘度の培養液であっても均一に混合することができ、気液接触効率が高く、かつ、菌体へのダメージの少ない培養装置を提供することを目的とするものである。

【０００５】

【課題を解決するための手段】

上記の目的を達成するために、本考案の培養装置は、図面を参照して説明すれば、上下端が開放されたドラフトチューブ１０を、縦型培養槽１２内に槽側壁１４、槽底壁１６及び槽蓋１８との間に間隙が生じるように設置した培養装置において、

ドラフトチューブ１０内の上部に設けられた下降流加速用撹拌翼２０と、

ドラフトチューブ１０の下部近傍に設けられた底部液排出加速用撹拌翼２２と、

ドラフトチューブ１０の外底部又は内部に設けられた散気管２４、４６と、

ドラフトチューブ１０を回転させる回転軸２６と、

を備えたことを特徴としている。

上記の培養装置において、下降流加速用撹拌翼２０の回転軸と、底部液排出加

速用撹拌翼２２の回転軸と、ドラフトチューブ１０回転用の回転軸２６とを共用するように構成するのが望ましい。

また、ドラフトチューブ１０の外周部に、ドラフトチューブが回転することにより上向きの力が生じるような形状の突起物２８、４４を設けるのが望ましい。

【０００６】

【作用】

培養槽１２内に同心円状に設置されたドラフトチューブ１０を、槽外部の駆動装置（図示せず）で回転させると同時に、下降流加速用撹拌翼２０及び底部液排出加速用撹拌翼２２を回転させ、培養液の下向きの流れを加速させるとともに、ドラフトチューブ内の液体をドラフトチューブ外へ加速しながら排出する。培養液への酸素供給は、ドラフトチューブ外底部に円周状に設置された散気管２４から上向きに空気を噴出し、外周部の培養液の上昇流を加速させながら行なわれる。

また、散気管４６がドラフトチューブ内に設置されている場合は、散気管４６から下向きに空気を噴出し、ドラフトチューブ内の培養液の下降流を加速させながら空気が混合される。

さらに、ドラフトチューブ外周部に突起物２８、４４を設けている場合は、回転するドラフトチューブにより、外周部の培養液の上昇流が加速される。

【０００７】

【実施例】

以下、図面を参照して本考案の好適な実施例を詳細に説明する。ただし、この実施例に記載されている構成機器の形状、その相対配置などは、とくに特定的な記載がない限りは、本考案の範囲をそれらのみに限定する趣旨のものではなく、単なる説明例にすぎない。

実施例１

図１において、１０は上下端が開放された円筒状のドラフトチューブで、円筒状の縦型培養槽１２内に、槽側壁１４、槽底壁１６及び槽蓋１８との間に間隙が生じるように同心円状に設置される。

ドラフトチューブ１０内の上部には、下降流加速用撹拌翼２０が設けられ、ド

ラフトチューブ１０の下側には、底部液排出加速用撹拌翼２２が設けられる。ドラフトチューブ１０の外底部には、散気管２４が設けられる。２６は回転軸で、ドラフトチューブ１０、下降流加速用撹拌翼２０及び底部液排出加速用撹拌翼２２を回転させるためのものである。

ドラフトチューブ１０の外周部には、ドラフトチューブが回転することにより上向きの力が生じるような形状の、スパイラル状又は傾斜板状の突起物２８が設けられている。また、ドラフトチューブ１０の上部には、複数のスリット３０が設けられている。このスリット３０は、液面がスリット３０近辺まで下降したときに、液をドラフトチューブ１０内に流入させるためのものである。３２、３４はドラフトチューブ１０と回転軸２６を連結するための連結具、３６は邪魔板、３８は培養液入口、４０は液出口、４２は排気口である。

【０００８】

実施例２

本実施例は、連続した突起物を代わりに、図２に示すように、不連続の突起物４４を設けたものである。他の構成は図１の場合と同様である。

【０００９】

実施例３

本実施例は、図３に示すように、ドラフトチューブ１０内に下向きに空気を噴出する散気管４６を設けたものである。図３では、一例として、回転軸２６を中空状とし、この中空部に空気を供給して、散気管４６から下向きに噴出するようにしている。この散気管４６は、底部の散気管の代わりに設けてもよく、又は両者を設けてもよい。他の構成は図１の場合と同様である。

【００１０】

【考案の効果】

本考案は、上記のように構成されているので、つぎのような効果を奏する。

（１）　高濃度菌体培養時等の高粘度（非ニュートン流体）に対しても、槽内全体が均一に混合でき、気液接触効率が高くなる。

（２）　ドラフトチューブ内の上部に下降流加速用撹拌翼を設けるとともに、ドラフトチューブの下部近傍に底部液排出加速用撹拌翼を設けているので、効率よ

く培養液を循環させることができる。

（3）　ドラフトチューブの外周部にスパイラル状の連続又は不連続の突起物を設ける場合は、培養液がドラフトチューブの外周部でスパイラル状に流動し、このため、菌体が一部自己増粒し、菌体の高濃度化が促進される。また、ドラフトチューブの回転エネルギーで液体を主に流動させるため、菌体へのダメージが少ない。